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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/510,078	12/14/2004	Mark Berman	267-88	4230
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EXAMINER PARK, EDWARD				
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2624				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/510,078

**Applicant(s)**

BERMAN ET AL.

**Examiner**

EDWARD PARK

**Art Unit**

2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on 28 April 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,2,5,6 and 10-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,5,6 and 10-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-8508)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Response to Amendment*

1. This action is responsive to applicant's amendment and remarks received on 4/28/08. Claims 1, 2, 5, 6, 10-17 are currently pending.

### *Claim Objections*

2. In response to applicant's amendment of claims 6, 1, 2, 5, and 11, the previous claim objections are withdrawn.
3. The following is a quotation of 37 CFR 1.75(a):

The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.
4. **Claim 16** is objected to under 37 CFR 1.75(a), as failing to conform to particularly point out and distinctly claim the subject matter which application regards as his invention or discovery. The term, "most recently estimated spectrum of each endmember", is not supported in the preceding claim 1 and therefore does not have antecedent basis. What is the most recently estimated spectrum of each endmember? Is it before or after the stopping condition? If the stopping condition is not met then is there a most recently estimated spectrum of each endmember? For examination purposes, the phrase will not be given any weight since it is not clear the scope and limitation that the phrase provides. Further clarification is needed.

**Claim 17** is objected to under 37 CFR 1.75(a), as failing to conform to particularly point out and distinctly claim the subject matter which application regards as his invention or

discovery. The term, "most recently estimated mixing proportions of each data value", is not supported in the preceding claim 1 or 16 and therefore does not have antecedent basis. What are the most recently estimated mixing proportions of each data value? Is it before or after the stopping condition? If the stopping condition is not met then is there a most recently estimated mixing proportions of each data value? For examination purposes, the phrase will not be given any weight since it is not clear the scope and limitation that the phrase provides. Further clarification is needed.

***Claim Rejections - 35 USC § 112***

5. In response to applicant's amendment of claims 1 and 5, and cancellation of claim 4, the previous claim rejections have been withdrawn.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. **Claims 1, 5, 12, 13, 14** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claims call for the element, "residual sum", and element deems the claims indefinite. What is meant by residual sum? What variables make up this residual sum? How is the residual sum related to the estimation of the mixing proportions and the estimation of the spectrum of each endmember? The scope of protection is unclear and the claims are therefore indefinite. The examiner will interpret the claim limitation as reasonably

broad as possible. The interpretation of residual sum will be any sort of summation method or process whether it deals with error compensation or general summation of values. Correction is required.

**Claims 1, 12, 13** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claims call for the element, “size of the simplex”, and the element deems the claims indefinite. What is meant size of the simplex? Is the size considered to be a volume? Is the size considered to be the area? Diameter? Number of elements? The scope of protection is unclear and the claims are therefore indefinite. The examiner will interpret the claim limitation as reasonably broad as possible. The interpretation of residual size will be any value that gives the simplex definition whether it is volume, area, width, quantity of simplexes, etc. Correction is required.

***Claim Rejections - 35 USC § 101***

8. In response to applicant’s arguments of claims 1-11, the previous claim rejection has been withdrawn.

***Claim Rejections - 35 USC § 102***

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(c) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. **Claims 1, 2, 10, 11, 12, 13, 14, 15, 16, 17** are rejected under 35 U.S.C. 102(b) as being anticipated by Keshava et al ("Spectral Unmixing", IEEE Signal Processing Magazine).

Regarding **claim 1 (as best understood)**, Keshava discloses a method of identifying endmember spectra values from multispectral image data, where each multispectral data value is equal to a sum of mixing proportions of each endmember spectrum, said method including the steps of:

processing the data to obtain a multidimensional simplex having a number of vertices equal to the number of endmembers, the position of each vertex representing a spectrum of one of the endmembers (see p. 53, left column, paragraph 3 – p. 53, right column, paragraph 1, estimates of endmember spectra may be derived from the vertices of the multifaceted simplex that tightly encloses the data and has the same number of endmembers as vertices),  
wherein the processing of the data includes: providing starting estimates of each endmember spectrum for each image data value (see p. 51, right column, paragraph 2 - p. 52, left column, paragraph 1 define a suite of image endmembers (selected from the image data), an image endmember is obtained by locating a pixel in the scene with the maximum abundance of the physical endmember it will represent);

estimating mixing proportions for each data value from the estimates of the spectra of all the endmembers (see p. 54, right column, paragraph 1, endmember determination is often interrelated with estimating the abundance vector,  $a$ , in the LMM (linear mixing model)); estimating the spectrum of each endmember from the estimates of the mixing proportions of the spectra of all the endmembers for each image data value (see p. 50, right column, paragraph 2 - p. 54, left column, last paragraph, geometric endmember determination ... estimates of endmember spectra may be derived from the vertices of the multifaceted simplex that most tightly encloses the data and has the same number of endmembers as vertices), and repeating estimation steps until a stopping condition is met, wherein the stopping condition occurs when a relative change in a regularized residual sum of squares determined in the estimation steps attains a threshold, wherein the regularized residual sum of squares includes a term which is a measure of the size of the simplex (see p. 53, left column, paragraph 3 - right column, paragraph 1; p. 54, right column, paragraph 1, estimates of endmember spectra may be derived from the vertices of the multifaceted simplex that most tightly encloses the data and has the same number of endmembers as vertices which is an optimization known as shrinkwrapping .... basis for arriving at estimates is a distance metric that is minimized ... some quantity related to squared-error (estimation is implicitly disclosed by minimization requiring repetition of estimations)).

Regarding **claim 2**, Keshava discloses sum of the squared distances between all of the simplex vertices (see p. 54, right column, paragraphs 1-5 least squares method .... estimates is a distance metric that is minimized).

Regarding **claim 10**, Keshava discloses utilizing a linear estimation technique (see p. 48, right column, paragraphs 1-5, exploiting the LMM through dimension reduction, endmember determination, and inversion).

Regarding **claim 11**, Keshava discloses utilizing a quadratic programming minimization technique (see p. 55, left column, paragraph 2, minimizing while maintaining falls in the domain of quadratic programming with linear inequalities as constraints).

Regarding **claims 12, 13**, Keshava discloses minimizing a first residual sum of squares, the first residual sum of squares comprising a term which is a measure of the size of the simplex, and minimizing a second residual sum of squares, the second residual sum of squares comprising a term which is a measure of the size of the simplex (see p. 53, left column, paragraph 3 - right column, paragraph 1; p. 54, estimates of endmember spectra may be derived from the vertices of the multifaceted simplex that most tightly encloses the data and has the same number of endmembers as vertices which is an optimization known as shrinkwrapping .... basis for arriving at estimates is a distance metric that is minimized ... some quantity related to squared-error ... minimizing squared-error through unconstrained least squares, full additivity or nonnegativity (estimation is implicitly disclosed by minimization requiring repetition of estimations)).

Regarding **claim 14**, Keshava discloses calculating a ratio comprising successive values of a minimized regularized residual sum of squares, wherein the successive values of the minimized regularized residual sum of squares are minima of the second and first regularized residual sum of squares calculated for each repetition of the estimation steps (see pg. 54, right column, second paragraph – sixth paragraph, pg. 55, left column, first - fourth paragraph; minimizing  $|x - S_a|^2$  while maintaining a ... the approach here is to iteratively estimate and at



every iteration, find a least squares solution for just those coefficients of  $a$  that are negative using only the associated columns of  $S$ ).

Regarding **claim 15**, Keshava discloses when the ratio attains a tolerance value (see p. 53, left column, paragraph 3 - right column, paragraph 1; p. 54, right column, paragraph 1, estimates of endmember spectra may be derived from the vertices of the multifaceted simplex that most tightly encloses the data and has the same number of endmembers as vertices which is an optimization known as shrinkwrapping).

Regarding **claim 16**, Keshava discloses identified endmember spectra values from the multispectral image data (see p. 53, left column, paragraph 3 - p. 53, right column, paragraph 1, estimates of endmember spectra may be derived from the vertices of the multifaceted simplex that tightly encloses the data and has the same number of endmembers as vertices).

Regarding **claim 17**, Keshava discloses identified proportions of each of the identified endmember spectra values present in each data value of the multispectral image data (see p. 54, right column, paragraph 1, endmember determination is often interrelated with estimating the abundance vector,  $a$ , in the LMM (linear mixing model)).

### *Claim Rejections - 35 USC § 103*

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. **Claims 5 and 6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Keshava et al ("Spectral Unmixing", IEEE Signal Processing Magazine).

In regards to **claims 5 and 6 (as best understood)**, Keshava discloses all elements as mentioned above in claim 1.

Keshava does not disclose expressly a ratio comprising successive values of regularized residual sum of squares and ratio attains 0.99999.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have a ratio comprising successive values of regularized residual sum of squares and ratio attains 0.99999. Applicant has not disclosed that a ratio comprising successive values of regularized residual sum of squares and ratio attains 0.99999 provides an advantage, is used for a particular purpose or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with either a regularized residual sum of squares as taught by Keshava in claim 1 or a ratio comprising successive values of regularized residual sum of squares and ratio attains 0.99999 because both utilize the regularized residual sum of squares which performs the same function of minimizing the error of the endmember spectra values.

Therefore, it would have been obvious to combine to one of ordinary skill in this art to modify Keshava to obtain the invention as specified in claims 5 and 6.

***Response to Arguments***

13. Applicant's arguments filed on 4/28/08, in regards to **claim 1**, have been fully considered but they are not persuasive. Applicant argues that Keshava does not anticipate the claim limitation because the reference assumes that endmembers are known or have been previously estimated (see pg. 7, third paragraph). This argument is not considered persuasive since the claim language in claim 1 does not specify that endmembers are to be estimated. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., endmembers are known or have been previously estimated) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant argues that Keshava does not disclose adding a term which is a measure of the size of the simplex to the residual sum of squares (see pg. 7, third paragraph). This argument is not considered persuasive since in Keshava, pg. 53, left column, paragraph 3 - right column, paragraph 1, pg. 54, right column, paragraph 1, it is disclosed that estimates of endmember spectra may be derived from the vertices of the multifaceted simplex that most tightly encloses the data, which is equivalent to the measure of the size of the simplex. Keshava further discloses in pg. 54, left column, paragraph 3 - right column, paragraph 1, pg. 54, right column, paragraph 1, that some quantity is related to squared-error which is equivalent to the residual sum of squares.

Furthermore, applicant argues that the Keshava reference does not disclose measure of the size of the simplex being the sum of the squared distances between all of the simplex vertices

to regularize the residual sum of squares (see pg. 7, third paragraph). In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., measure of the size of the simplex being the sum of the squared distances between all of the simplex vertices to regularize the residual sum of squares) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant argues that Keshava makes no mention of minimizing the error in the estimates (regularized residual sum of squares) by including a term which is a measure of the size of the simplex (pg. 7, last paragraph). This argument is not considered persuasive since in Keshava, pg. 53, left column, paragraph 3 - right column, paragraph 1, pg. 54, right column, paragraph 1, it is disclosed that basis for arriving at estimates is a distance metric that is minimized, which is equivalent to minimizing the error in the estimates; Keshava also discloses that estimates of endmember spectra may be derived from the vertices of the multifaceted simplex that most tightly encloses the data, which is equivalent to the measure of the size of the simplex. Keshava further discloses in pg. 54, left column, paragraph 3 - right column, paragraph 1, pg. 54, right column, paragraph 1, that some quantity is related to squared-error which is equivalent to the residual sum of squares.

Applicant further argues that Keshava does not disclose any algorithm for estimating the endmembers based on using a term which is a measure of the size of the simplex (see pg. 8, last paragraph). In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., algorithm

for estimating the endmembers based on using a term which is a measure of the size of the simplex) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant argues that Keshava does not disclose a regularized least squares estimation method (see pg. 8, last paragraph). In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., regularized least squares estimation method) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). The claim limitation calls for a regularized residual sum of squares.

Applicant argues that Keshava does not disclose repeating estimation steps until a stopping condition is reached (see pg. 9, first paragraph). This argument is not considered persuasive since in Keshava, p. 53, left column, paragraph 3 - right column, paragraph 1; p. 54, right column, paragraph 1, estimates of endmember spectra may be derived from the vertices of the multifaceted simplex that most tightly encloses the data and has the same number of endmembers as vertices which is an optimization known as shrinkwrapping. The estimation and optimization invokes that an estimation method is executed until a stopping condition is reached, in this case, encloses the data and has the same number of endmembers as vertices.

Applicant argues that Keshava does not disclose incorporating a measure of the size of the simplex into a least squares method to estimate the endmembers (see pg. 9, first paragraph). In response to applicant's argument that the references fail to show certain features of applicant's

invention, it is noted that the features upon which applicant relies (i.e., incorporating a measure of the size of the simplex into a least squares method to estimate the endmembers) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). The claim calls for the limitation of estimating the spectrum each endmember from the estimates of the mixing proportions for each data value from the estimates of the spectra of all the endmembers. The claim does not call for the direct estimating of endmembers from a measure of the size of the simplex into a least squares method.

Applicant argues that the measure of the size of the simplex would thus be fixed, therefore the Keshava reference can not be utilized (see pg. 9, first paragraph). This arguments is not considered persuasive since the claim limitation of 1 does not invoke that the repetition of the estimation will actually occur. The claim states that “repeating the estimation steps until a stopping condition is met”. If the stopping condition is met on the first trial then the starting estimates will not be changed. Therefore, the applicant’s arguments are not considered persuasive since the claim does not specifically state that there will be more than one iteration.

Applicant argues that Keshava admits that there are no known technologies of combining parametric and geometric teachings and therefore Keshava does not describe the subject matter of claim 1 (see pg. 10, first paragraph). This argument is not considered persuasive since no place in the Keshava reference does the reference state the combining of parametric and a geometric teaching is not known. The Keshava reference being silent about combining the two teachings is no admittance that the there are no known technologies of combining the two.

Regarding **claims 5 and 6**, applicant argues that the claims are allowable due to the dependency on claim 1 and the reasons stated with respect to claim 1. This argument is not considered persuasive since the rejection of claim 1 stands and the arguments and rejection can be seen above.

### ***Conclusion***

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDWARD PARK whose telephone number is (571)270-1576. The examiner can normally be reached on M-F 10:30 - 20:00, (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Edward Park  
Examiner  
Art Unit 2624

/Edward Park/  
Examiner, Art Unit 2624

/Vikkram Bali/  
Supervisory Patent Examiner, Art Unit 2624